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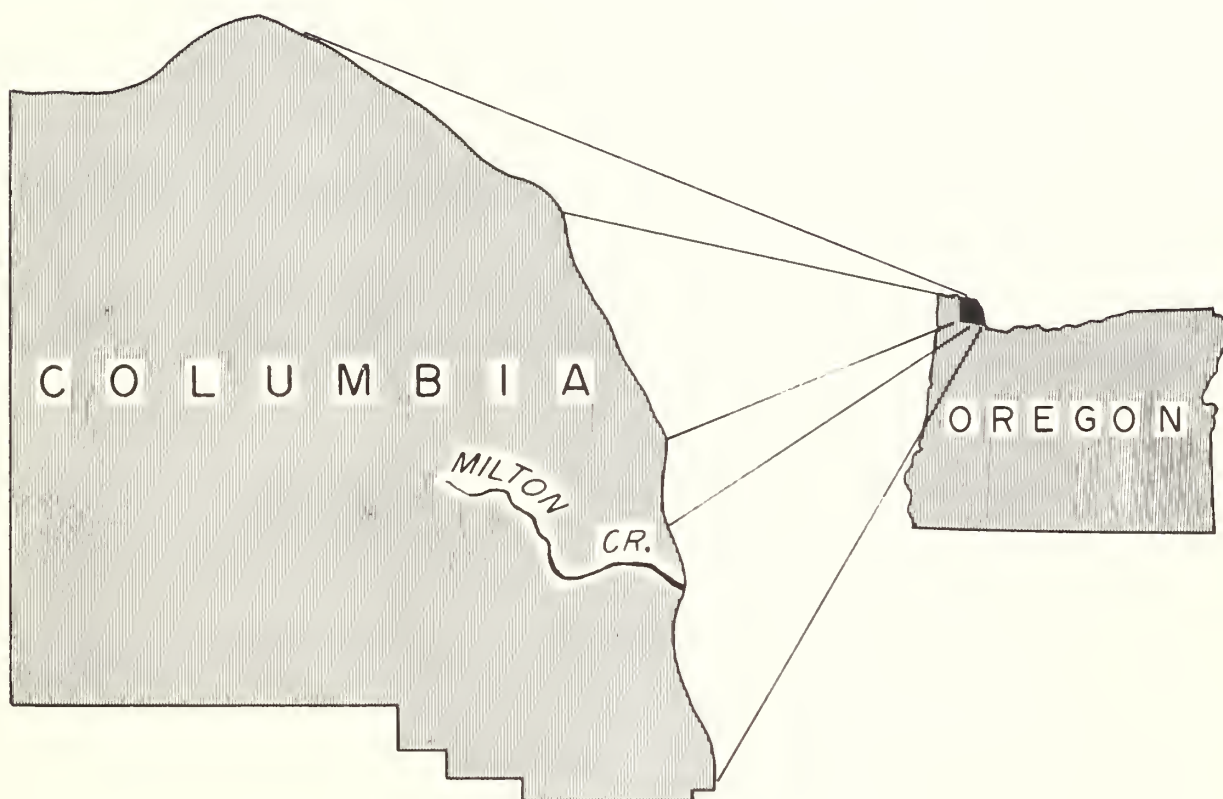


Floodplain Management Study

Milton Creek Columbia County, Oregon

in Cooperation with Columbia Soil and Water
Conservation District, Oregon Department of
Water Resources, and Columbia County

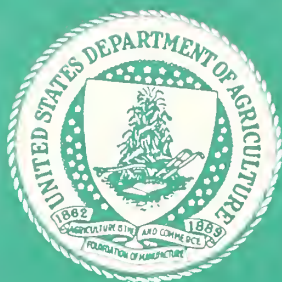
Technical Appendix



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MILTON CREEK FLOODPLAIN MANGEMENT STUDY
TECHNICAL APPENDIX

INTRODUCTION

The technical appendix for the Milton Creek Floodplain Management Study presents supplemental data not included in the report. This data is the review of procedures used in the investigations and analyses, discharge values determined, water surface elevations computed, and elevation reference marks established. A discussion of the floodway concept and the analysis made is also in the technical appendix.

Attachments to the appendix are:

1. Reference Mark Descriptions.
2. Flood Hazard Maps with proposed floodway indicated (6 sheets).
3. Flood Profiles giving profile of three flows through study reach.

INVESTIGATIONS AND ANALYSES

FIELD SURVEYS

Field surveys of the stream and valley cross-sections were completed in 1982. These surveys were of third order accuracy. There were 23 cross-sections surveyed, including eight bridge sections. Eight high-water marks from historic floods were located from interviews with local residents. The elevation of these high-water marks was determined by field survey. U.S. Geological Survey sea level datum was used for all the surveying.

Elevation Reference Marks established by USGS or Oregon State Highway were available at several locations throughout the study area. These were used as vertical control for the field survey. One Reference Mark (RM6) was established during the study to allow better access to geodetic elevation in future study. The Reference Mark descriptions are tabulated in Attachment 1 of the Technical Appendix.

HYDROLOGIC ANALYSIS

Seventeen streamgages were investigated for use in regional frequency analysis. Five of the gages were dropped from analysis due to short periods of record. Three additional gages were in areas with different climatic conditions than experienced in Milton Creek and were not used. The remaining nine gage records were used in the discharge vs. frequency analysis. The nine streamgages whose records were used are: (1) Gales Creek near Gales Creek, Oregon, (2) Gales Creek near Forest Grove, Oregon, (3) Salmon Creek near Battleground, Washington, (4) Salmon Creek near Toledo, Washington, (5) Delameter Creek near Castle Rock, Washington, (6) Cowman River near Kelso, Washington, (7) Elockoman River near Cathlamet, Washington, (8) Jim Crow Creek near Gray's River, Washington, and (9) Young's River near Astoria, Oregon. Discharge vs. frequency relationship was developed for each gage using the Log-Pearson Type 3 statistical procedure, as described in Bulletin 17B (Editorial correction March 1982) of the Interagency Advisory Committee on Water Data. Regression equations of peak discharge vs. drainage area were developed for several frequencies of storm using the discharge vs. frequency of the nine gages.

A further analysis by floodrouting was made of the watershed in which the watershed was divided into subwatersheds. Hydrographs were developed and then floodrouted to the outlet. The procedure used is from SCS Technical Release No. 20, "Project Formulation Program - Hydrology." Input to this program includes rainfall data attained from rainfall-duration-probability maps, hydrologic soil types; average slope of the watershed and streambed, land use, stream cross-section data, time of concentration, and stream travel times.

Results obtained from the two methods of analysis were compared. The discharge vs. frequency curves developed from streamgage data gave higher values than the curves obtained by floodrouting. The streamgage frequency curves plotted with less slope than the routed data curves, making a lesser 100-year to 10-year peak flow ratio. This was interpreted to indicate that the streamgage annual peak data included some moderate storms with a high antecedent moisture condition (AMC). Computing the 10-year peak flow using TR-20 and an AMC halfway between conditions II and

III gave a frequency curve with the same slope as the streamgage records had obtained. Subsequent computations of water surface profiles indicated that the peak flows discharge-frequency generated from streamgage records gave better agreement with known flooding conditions and high-water marks in the study area than the TR-20 results did. These streamgage discharge vs. frequency values were used in the analysis and for the floodplain mapping. Table A lists the discharges used in the study.

TABLE A-1
DISCHARGE FREQUENCY DATA

	<u>Discharge (cfs) at Cross-Section Nos.</u>		
<u>Frequency</u>	<u>10-50</u>	<u>52-60</u>	<u>62-72</u>
10-year	3,220	2,070	1,680
25-year	3,790	2,410	1,950
50-year	4,090	2,630	2,140
100-year	4,400	2,830	2,300
500-year	5,020	3,230	2,620

HYDRAULIC ANALYSIS

The flood elevations for the various frequency storms were determined using the procedures of SCS Technical Release No. 61, "WSP-2 Computer Program." This program uses the standard step method for running back-water curves. Survey data from the 33 cross-sections were used as input to the program. The channel and floodplain distance between each cross-section was measured on the aerial photographs. Roughness coefficients (n-values) were determined by field analysis.

Starting elevations at the mouth of the creek for each of the profiles were obtained from Corps of Engineers (CofE) data for the Columbia River. A second starting elevation at 1.5 feet above critical depth was used to determine the extent of upstream effect of the Columbia River flood levels. This determined that there is no effect from the Columbia River at Old Portland Road.

The velocity and elevation at each cross-section for the 10-, 25-, 50-, 100-, and 500-year flood events was determined from the WSP-2 program. Flood elevations calculated using the streamgage values were compared with the high-water mark information from historic floods. The consistent relationship between the data supported the validity of the analyses. Elevation vs. frequency data obtained through this study is listed on Table A-2.

The 100-year and 500-year flood areas inundated were located on the aerial photomaps using the survey cross-sections. The extent of flooding was field checked using the flood elevations. Area inundated between cross-sections was determined by field survey using interpolated flood elevations.

(Table A-2 follows)

TABLE A-2
TABULATION OF WATER SURFACE ELEVATIONS

SEA LEVEL DATUM (SLD)

Cross- Section No.	Station (Feet)	Channel Bottom Elevation	Water Surface Elevations			
			10% (10-Yr)	2% (50-Yr)	1% (100-Yr)	0.2% (500-Yr)
12	51+60	28.0	33.6	34.3	34.5	34.9
14	74+90	48.6	58.0	58.9	59.2	59.8
16B	76+00	55.0	65.8	67.3	67.6	67.9
18	77+00	55.1	65.9	67.5	67.7	68.1
20	96+90	67.2	74.2	75.2	75.6	76.3
22	105+80	77.1	82.4	83.0	83.2	83.6
24	118+30	86.1	93.6	94.4	94.8	95.2
26B	121+30	91.2	99.9	101.1	101.3	101.8
28	123+20	92.3	100.5	101.5	101.8	102.2
30	125+90	92.3	101.2	102.1	102.4	102.8
31B	127+40	97.5	101.7	102.5	102.7	103.1
32	132+10	102.0	106.5	107.1	107.3	107.6
34	143+60	118.4	124.0	124.4	124.5	124.8
36	153+20	124.4	130.5	131.2	131.5	131.8
38B	158+20	128.1	134.3	135.2	135.3	138.1
40	160+40	130.1	136.0	136.8	137.0	138.6
42	198+40	159.5	166.3	167.1	167.4	167.8
44	207+30	163.0	171.5	172.3	172.5	173.0
46B	208+30	164.3	174.2	175.0	175.2	175.6
48	210+50	164.9	174.7	175.5	175.7	176.2
50	234+70	177.4	187.4	188.2	188.4	188.8
52	293+10	191.0	201.7	202.4	202.7	203.2
54B	296+40	192.7	202.7	203.5	203.8	204.3
56	298+70	194.4	203.4	204.3	204.6	205.2
58	343+70	196.4	208.7	209.6	210.0	210.6
60	368+00	201.2	210.2	211.1	211.5	212.1
62	407+80	208.0	214.2	215.0	215.3	215.9
64B	409+70	210.6	216.5	217.4	217.7	218.2
66	412+70	209.0	217.8	218.9	219.3	220.0
68	419+60	209.7	218.8	219.8	220.2	220.8
70B	426+80	211.0	219.1	220.1	220.4	221.0
72	422+90	204.6	219.7	220.8	221.2	221.9

FLOODWAY

Encroachment on floodplains, by structures and/or filling, reduces the flood-carrying capacity and increases flood height, thus increasing flood hazards in areas upstream and downstream from the encroachment itself. One realistic aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard and potential damage.

The concept of a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area inundated by the 100-year flood is divided into "floodway" and "floodway fringe areas." The floodway is the channel of a stream plus adjacent floodplain areas that must be kept free of encroachment in order that the 100-year flood be carried within a certain specified maximum difference in flood height. Regulations enacted by the Federal Emergency Management Agency (FEMA), limit such increases in flood heights to a maximum of one foot.

The area between the designated floodway and the boundary of the 100-year flood is called the "floodway fringe." No encroachment into the floodway should be allowed; however, building in the floodway fringe could be permitted if flood levels are above the 100-year flood elevation. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown on Figure 1.

Diking is considered an encroachment on the floodplain the same as filling. Diking should only occur in the floodway fringe area.

In this report, floodways are proposed to the local governments as minimum standards that can be adopted or that can be used as a basis for additional studies and refinement. A proposed floodway was determined using SCS TR No. 64, "Floodway Determination Computer Program," between cross-section 20 and 40 and also sections 64 and 70. This provided a floodway width and location on the cross-section of the stream. Location of the floodway between cross-sections was determined by field observation and map analysis. The proposed floodway for Milton Creek is within the present stream banks and does not extend outside of existing channels.

ALTERNATIVES FOR FLOODPLAIN MANAGEMENT

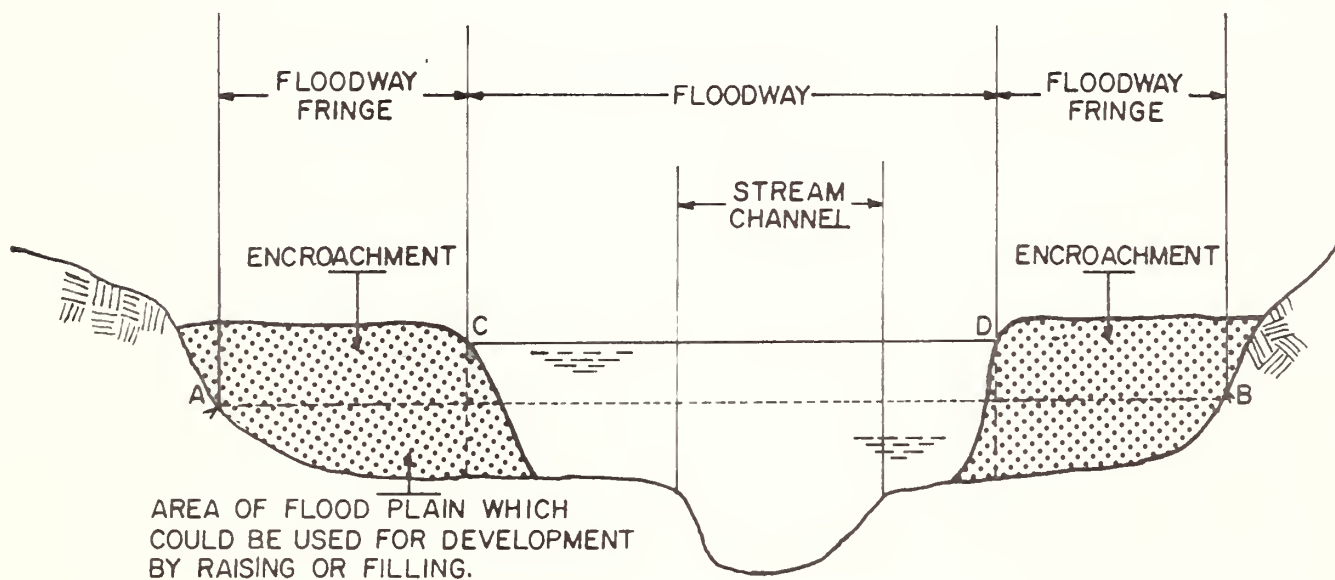
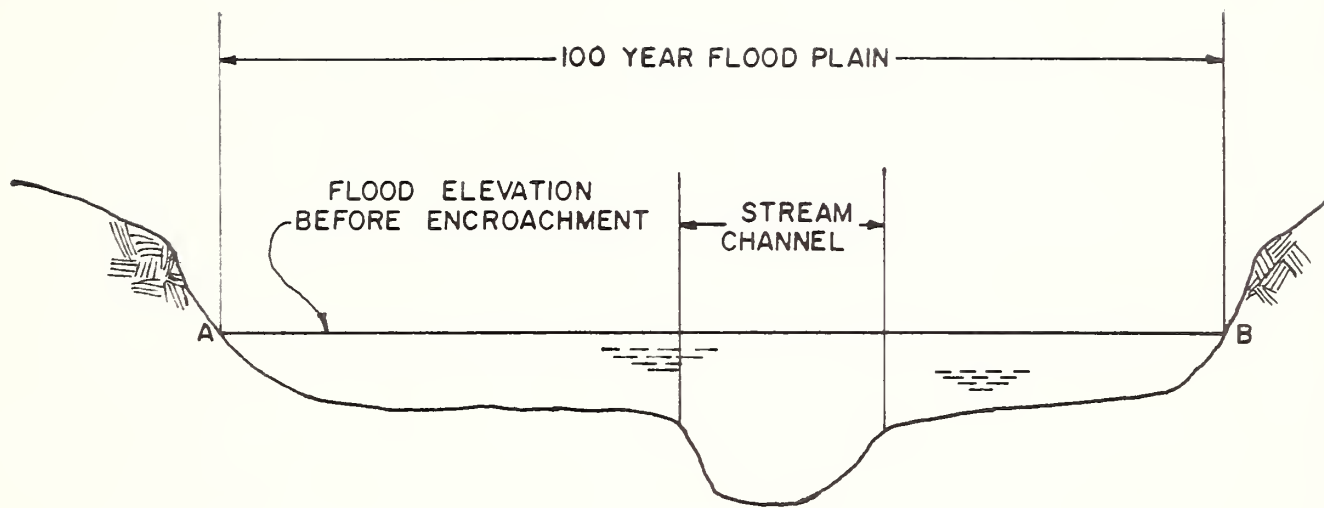
Investigations into the various alternative managements were conducted at a low level of intensity. Decisions were based upon preliminary calculations, existing data, and professional engineering opinion and experience. There was available data from three previous water and related land resource studies which was the basis of some of the alternatives. Other data for alternatives was developed as part of the study. The intent of this investigation was to provide a conceptual understanding of various floodplain management options that may be considered by county and city officials as potential solutions to flood hazards. Implementations of specific management options should be attempted only after a more detailed investigation.

FLOOD HAZARD EXHIBITS

Flood hazard photomaps of the Milton Creek study area are reproduced in Attachment 2. These photomaps are the same maps as included in the Report, Appendix B, with the addition of a proposed floodway. The photomaps show the area inundated by the 100-year and 500-year floods. In the places where only the 100-year floodplain is indicated, the line represents both the 100-year and 500-year floodplains. This is because the two floodplains are so close together that only one line could be shown on the drawings. The floodway is shown on the photomap, sheets 2, 3 and 6. The flood elevations were computed at each cross-section and the elevation between cross-sections has been interpolated. After computing the flood elevations, the outline of the floodplain was developed in the field. It is possible that small local islands exist within the floodplain and are not shown on the photomaps. Some slight flooding may occur outside the designated floodplain due to concentrated local runoff from adjacent areas. To determine the flooding potential at a specific location, a field survey would be required using the computed or interpolated flood elevations.

Each of the surveyed cross-sections and available reference (benchmarks) marks are located on the photomaps. The elevation of the 100-year flood is given at each cross-section on the maps.

Flood profiles are presented in Attachment 3. The profiles show the river bottom, and the 10-, 100-, and 500-year flood elevations. Cross-section locations and their stationing are shown. The river mile index is also shown on the profiles. The profile will give an indication of the depth of flooding at the deepest point on each surveyed cross-section and the slope of the flow lines. The bridges in the study are located on the profiles.



LINE A-B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
 LINE C-D IS THE FLOOD ELEVATION AFTER ENCROACHMENT

FLOODWAY RELATIONSHIPS

FIGURE 1

ATTACHMENT 1

MILTON CREEK FLOODPLAIN MANAGEMENT STUDY

ELEVATION REFERENCE MARKS

<u>Reference Mark</u>	<u>Elevation</u>	<u>Description of Location</u>
RM 1	66.56	Old Portland Road and north side of Milton Creek and east side of bridge - Brass disc set on concrete railing base.
RM 2	98.84	0.2 mile S.W. of the BN Railway station on Columbia River Highway (U.S. 30) about 800 ft. south of the main intersection, at the S.E. corner of the highway bridge over Milton Creek, in the top of the curb. Disc stamped "98 S103 1929."
RM 3	99.44	0.15 mile S.W. of the BN Railway station on U.S. 30 about 700 ft. south of the main intersection, at the N.E. corner of the highway bridge over Milton Creek, in the top of the curb. Disc stamped "98.97 Q 204 1925."
RM 4	107.07	Columbia Blvd. at Milton Creek, N.E. corner of bridge - Brass disc set in concrete railing base.
RM 5	139.06	Pittsburg Road at Milton Creek, N.E. corner of bridge - Brass disc.
RM 6	222.50	On Hanky Road about 1.4 miles N.W. of junction with Pittsburg Rd., St. Helens. At Pete McGilvra driveway, south side of Hanky road. 44 feet south of edge of Hanky road at centerline of driveway. 31.5 feet SE/S of powerpole 79-15-25 and 10 ft. south of edge of driveway. Brass disc set in 10" x 12" concrete post flush with ground. No marking on disc.
RM 7	217.78	From the railroad depot in St. Helens, go north on U.S. 30 for 0.5 mile to side road-- turn left. At sign "Pittsburg Road, Yankton" turn left as per sign and go N.W. on Pittsburg Rd. for 2.8 miles to the benchmark on the left at the intersection of Pittsburg Rd and Robinette Rd which is 1.0 mile east of the Yankton School. The benchmark is set in 10 inch-square concrete monument that projects 3 inches. 0.05 mile west of the bridge over Milton Creek, 55 ft. east of the center of a driveway south, 40 ft. west of powerpole #12222, 24 ft. south of the center of Pittsburg Road, 22 ft. west of road sign, 19 ft. west of the prolonged center of Robinette Rd, 1ft. west of metal witness post, and 0.5 ft. north of concrete wall that is 6 inches high.

<u>Reference Mark</u>	<u>Elevation</u>	<u>Description of Location</u>
RM 8	283.99	E 204 (USC&GS). About 3.8 miles west of St. Helens on Pittsburg Rd., 55 ft. N.E. of center of road intersection, S.W. corner of Yankton Ditricht 30 schoolyard. Disc stamped "284 E 204 1934" in concrete post.

ATTACHMENT 2
FLOOD HAZARD MAPS

COLUMBIA CO



LOCATION MAP



VICINITY MAP and PHOTOMAPINDEX
MILTON CREEK FLOOD HAZARD STUDY AREA
COLUMBIA COUNTY, OREGON

SCALE 0 1778 FEET
0 200 400 METERS
APPROXIMATE

SOURCE:
PHOTO COVERAGE AND INFORMATION
FROM SCS FIELD PERSONNEL

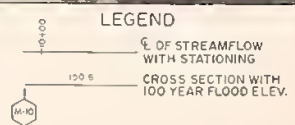
LEGEND



STREAM CENTERLINE

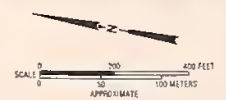


SHEET COVERAGE



PHOTOMAP BASE IS FROM U.S.O.A.-A.S.G.S.
 FLIGHT OF 5-3-80.
 THEMATIC DETAIL PREPARED BY OREGON
 STATE STAFF.

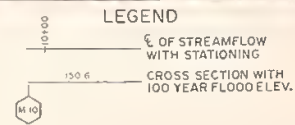
+ RM-2 BENCH MARK



MILTON CREEK
 FLOODPLAIN MANAGEMENT STUDY AREA
 COLUMBIA COUNTY, OREGON

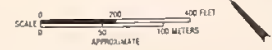
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SOIL CONSERVATION SERVICE

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Traced.....	Sheet No. 1	Drawing No.
Checked.....	at 10	March 1984 4-R-38512



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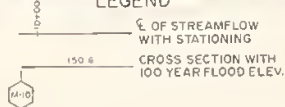
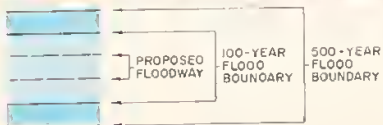
RM-2 BENCH MARK



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U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
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	Drawn By
	March 1984 4-R-35192



LEGEND



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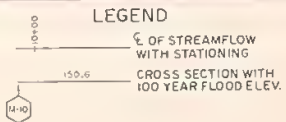
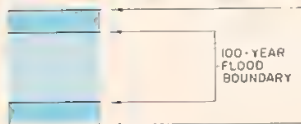
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APPROXIMATE

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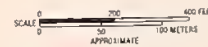
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SOIL CONSERVATION SERVICE

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STATE STAFF.

RM-2 BENCH MARK



MILTON CREEK FLOODPLAIN MANAGEMENT STUDY AREA COLUMBIA COUNTY, OREGON

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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Approved by	Title	Sheet No. 4	Drawing No. March 1984 4 R-38512



MILTON CREEK
FLOODPLAIN MANAGEMENT STUDY AREA
COLUMBIA COUNTY, OREGON

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

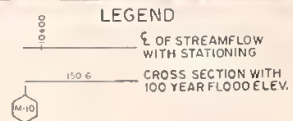
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LEGEND

- 100-YEAR FLOOD BOUNDARY
- 500-YEAR FLOOD BOUNDARY
- LINE OF STREAMFLOW WITH STATIONING
- CROSS SECTION WITH 100 YEAR FLOOD ELEV.
- RM-2 BENCH MARK

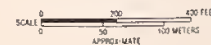
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0 50 100 METERS
APPROXIMATE



PHOTOMAP BASE IS FROM U.S.O.A.-A.S.C.S.
FLIGHT OF 5-3-80.
THEMATIC DETAIL PREPARED BY OREGON
STATE STAFF.

+ RM-2 BENCH MARK



MILTON CREEK FLOODPLAIN MANAGEMENT STUDY AREA COLUMBIA COUNTY, OREGON

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed.....	Date.....	Approved By.....
Drawn.....	Title.....	
Traced.....	Sheet No. 6	Drawn No. 6
Checked.....	March 1984	4 R-38512

Elevation in feet (mean sea level)

LOWER LIMIT OF STUDY

MATCH TO SHEET NO 2

LEGEND

- 500 Year Flood Profile
- 100 Year Flood Profile
- 10 Year Flood Profile
- Stream Bottom



Cross Section

0 400 800 feet



0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2
10+00 14+00 18+00 22+00 26+00 30+00 34+00 38+00 42+00 46+00 50+00 54+00 58+00 62+00

Stationing (in feet) & River Mile Index

Attachment 3 sheet 1 of 8

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

PROFILE

FLOODPLAIN MANAGEMENT STUDY
MILTON CREEK
COLUMBIA COUNTY, OREGON

ATTACHMENT 3

FLOOD PROFILES

LEGEND

500 Year Flood Profile

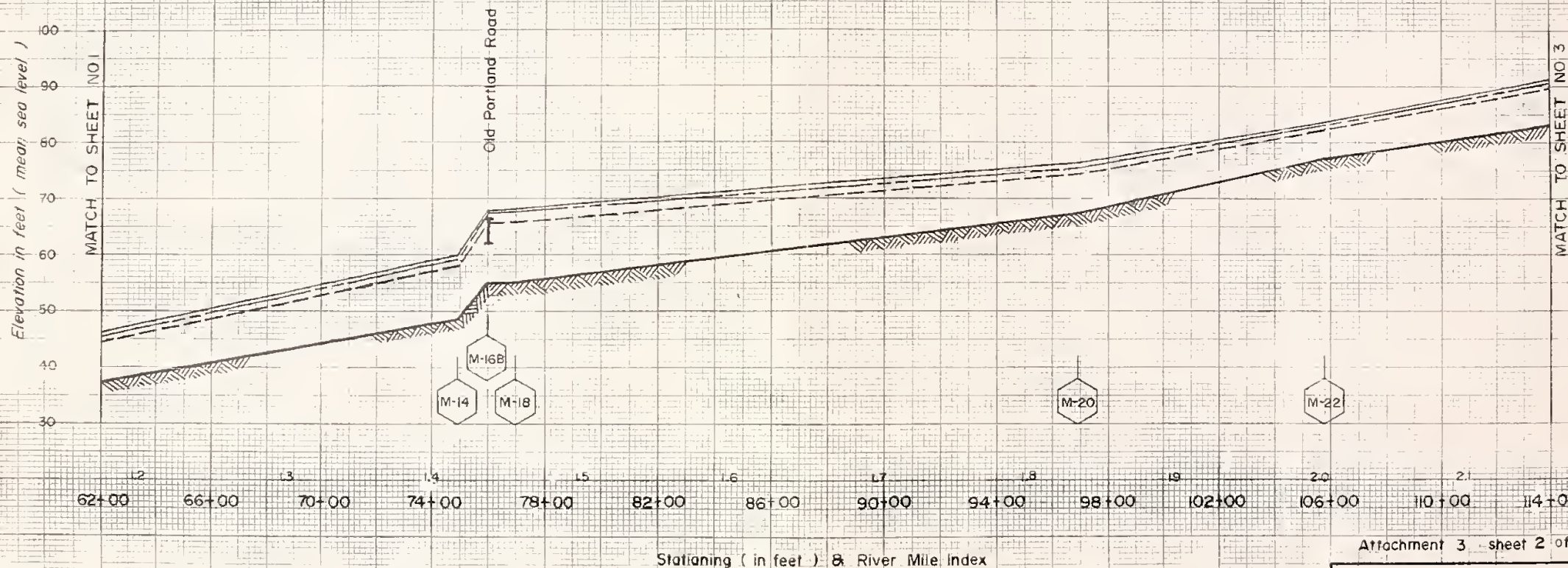
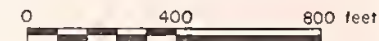
100 Year Flood Profile

10 Year Flood Profile

Stream Bottom

M-22

Cross Section



Attachment 3 sheet 2 of 8

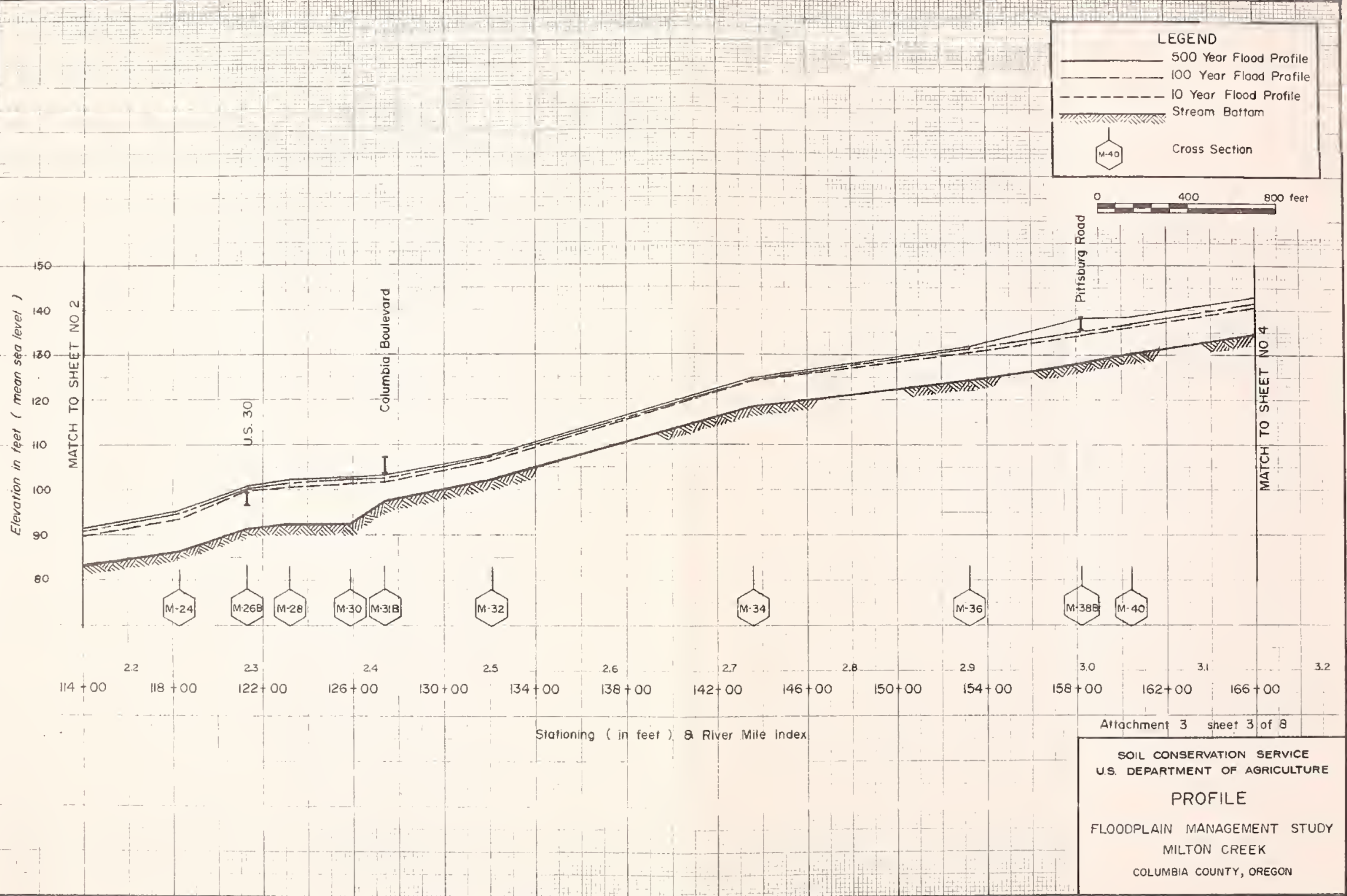
SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

PROFILE

FLOODPLAIN MANAGEMENT STUDY

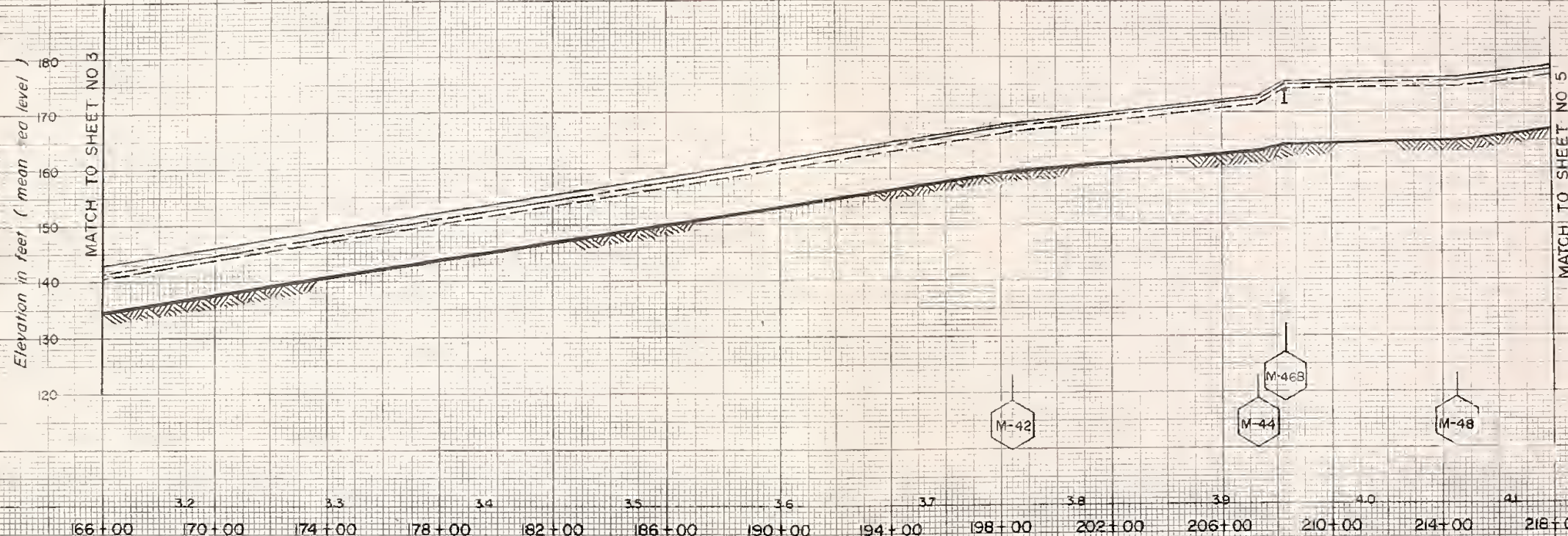
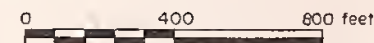
MILTON CREEK

COLUMBIA COUNTY, OREGON



LEGEND

- 500 Year Flood Profile
- 100 Year Flood Profile
- 10 Year Flood Profile
- Stream Bottom
- Cross Section



166+00 170+00 174+00 178+00 182+00 186+00 190+00 194+00 198+00 202+00 206+00 210+00 214+00 218+00

Stationing (in feet) & River Mile Index

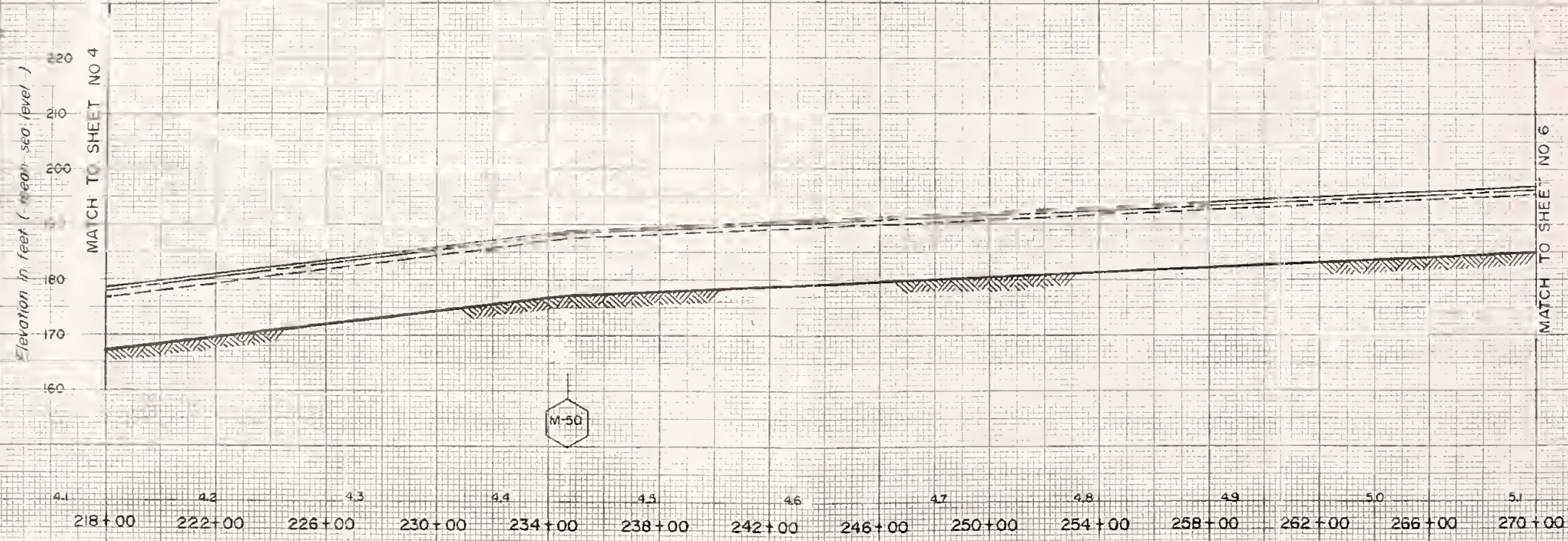
Attachment 3 sheet 4 of 8

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

PROFILE
FLOODPLAIN MANAGEMENT STUDY
MILTON CREEK
COLUMBIA COUNTY, OREGON

LEGEND

- 500 Year Flood Profile
- 100 Year Flood Profile
- 10 Year Flood Profile
- Stream Bottom
- Cross Section



Stationing (in feet) & River Mile Index

Attachment 3 sheet 5 of 8

SOIL CONSERVATION SERVICE
 U.S. DEPARTMENT OF AGRICULTURE

PROFILE

FLOODPLAIN MANAGEMENT STUDY

MILTON CREEK

COLUMBIA COUNTY, OREGON

LEGEND

500 Year Flood Profile

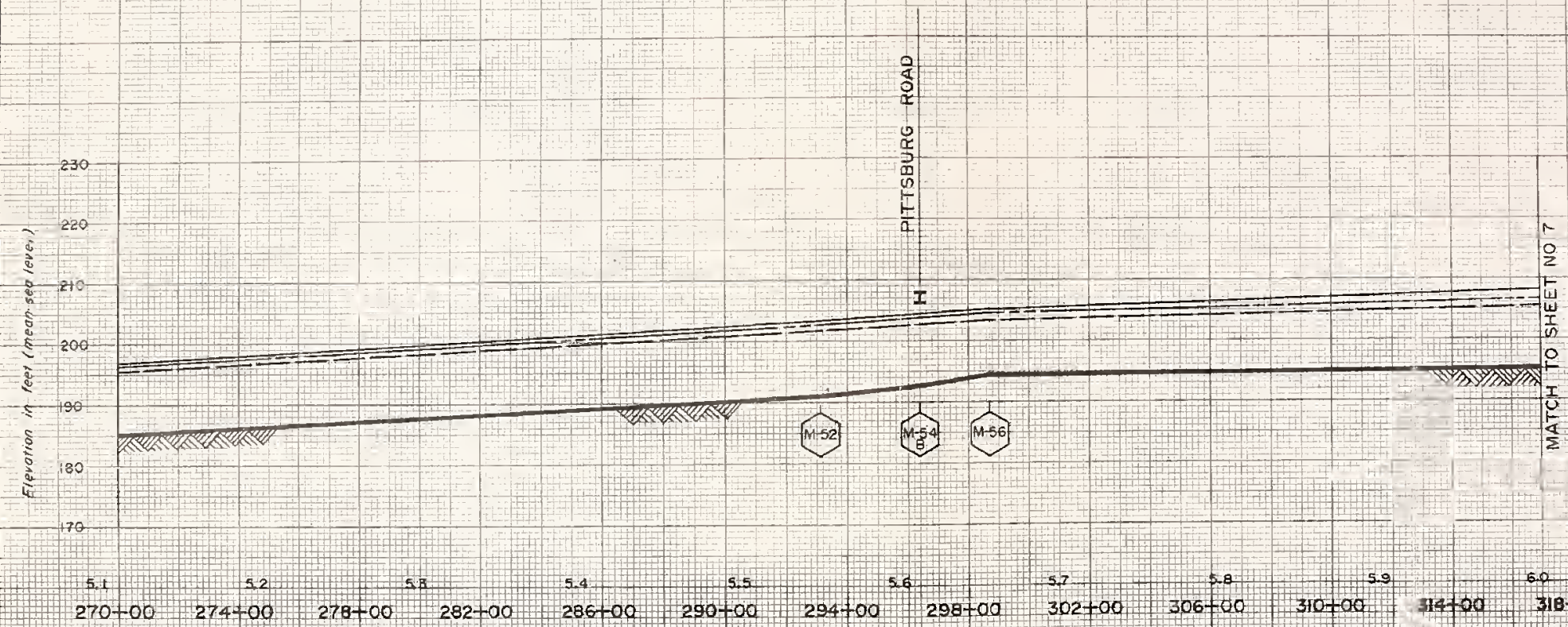
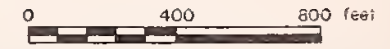
100 Year Flood Profile

10 Year Flood Profile

Stream Bottom

M-56

Cross Section



Attachment 3 sheet 6 of 8

SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF AGRICULTURE

PROFILE

FLOODPLAIN MANAGEMENT STUDY

MILTON CREEK

COLUMBIA COUNTY, OREGON

LEGEND

- 500 Year Flood Profile
- 100 Year Flood Profile
- 10 Year Flood Profile
- Stream Bottom



Cross Section

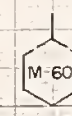


Elevation in feet (mean sea level)

240
230
220
210
200
190
180

MATCH TO SHEET 6

MATCH TO SHEET NO 8



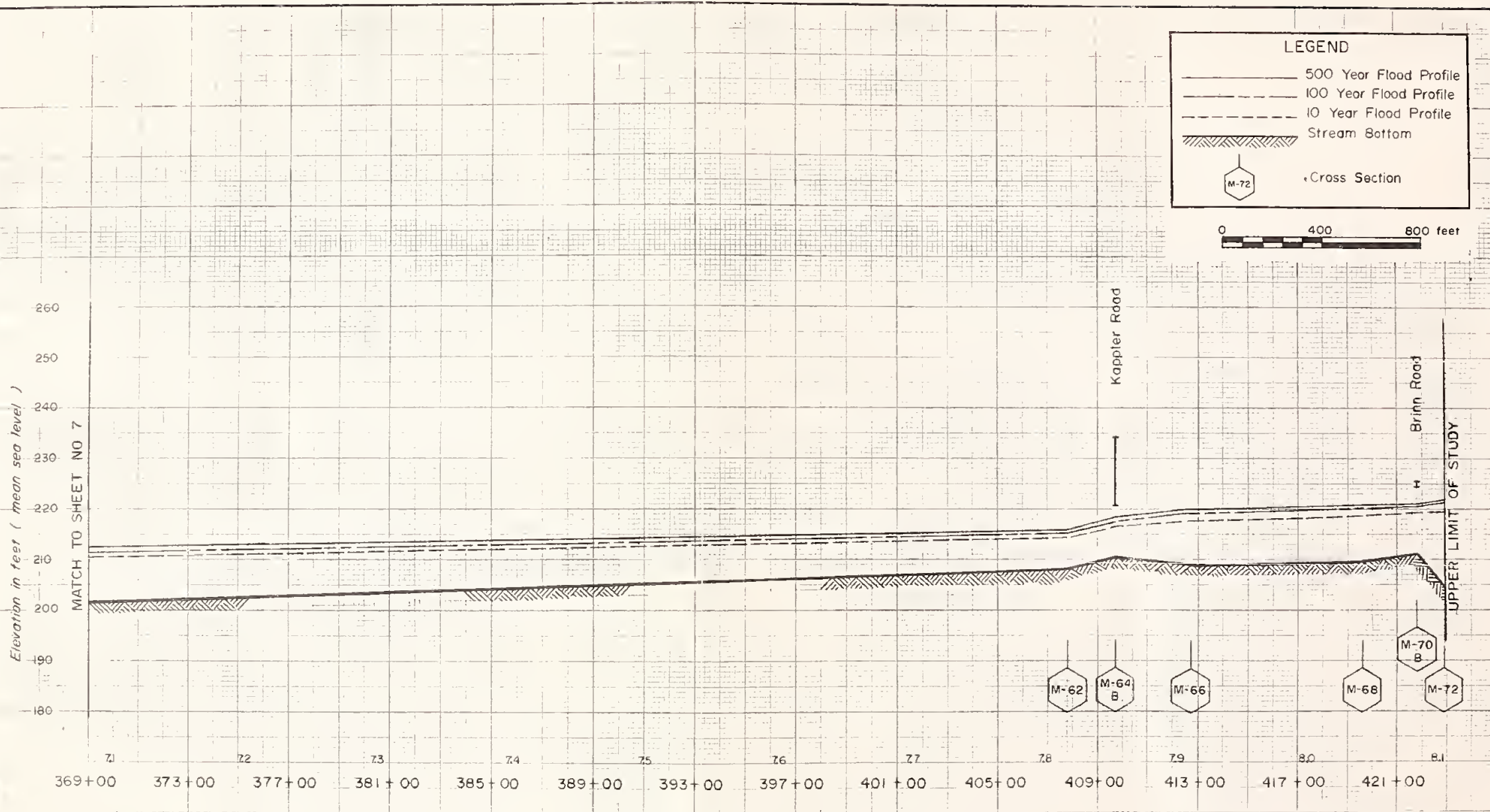
6.1 6.2 6.3 6.4 6.5 6.6 6.7 6.8 6.9 7.0 7.1
317+00 321+00 325+00 329+00 333+00 337+00 341+00 345+00 349+00 353+00 357+00 361+00 365+00 369+00

Stationing (in feet) & River Mile Index

Attachment 3 sheet 7 of 8

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

PROFILE
FLOODPLAIN MANAGEMENT STUDY
MILTON CREEK



LEGEND

- 500 Year Flood Profile
- - - 100 Year Flood Profile
- . - 10 Year Flood Profile
- ▨ Stream Bottom
- ⬡ M-72 • Cross Section



Stationing (in feet) & River Mile Index

Attachment 3 sheet 8 of 8

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

PROFILE

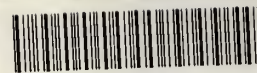
FLOODPLAIN MANAGEMENT STUDY
MILTON CREEK

COLUMBIA COUNTY, OREGON



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